June 1943 E-596

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Entomology and Plant Quarantine

THE EUROPEAN CORN BORER AND ITS CONTROL IN DAHLIAS

By C. H. Batchelder, D. D. Questel, and A. V. Cosenza,
Division of Cereal and Forage Insect Investigations

CONTENTS

INTRODUCTION

The European corn borer (Pyrausta nubilalis (Hbn.)) is a serious pest of dahlias in the northeastern part of the United States.1/

As its name implies, the insect is most widely known as a pest of corn, although it also infests other cultivated crops, some weeds, and several ornamental garden plants.

The European corn borer infests all types and varieties of dahlias. Certain varieties may sometimes show more infestation than others, owing to differences in the size and growth stage of the plants when the eggs of the insect were being laid.

1/ The European corn borer in 1942 was known to occur in Wisconsin, Missouri, Iowa, and eastward to Maine and North Carolina, as well as in Ontario, Quebec, and the Maritime Provinces of Canada.

DAHLIA BORERS, NATIVE AND INTRODUCED

In addition to the European corn borer, a native insect known as the stalk borer (Papaipema nebris nitela (Guen.)) bores in the stems of dahlias in June and July. It has a light-tan head, a transverse, dark-brown band near the middle of its body, and brown, interrupted, longitudinal stripes on its sides. This native stalk borer is rarely as numerous as the European corn borer. The latter is a grayish-pink caterpillar with a dark-brown head, and when fully grown is about 1 inch in length. It attacks various parts of the plant and occurs on dahlias in greatest numbers during August and September. The treatments discussed in this circular are not recommended for control of the native stalk borer.

HOW TO RECOGNIZE EUROPEAN CORN BORER INJURIES IN DAHLIAS

Signs of infestation usually begin to appear late in July and early in August and continue to develop until frost. The occurrence of egg masses of the corn borer on the under side of lower leaves, as shown in figures 1 and 2, is a timely warning of impending infestation of dahlias. Later, one may observe that some of the foliage and flower buds have wilted. Infested buds turn black, and beside them one may find small masses of black, granular castings, called frass, which have been pushed out by burrowing larvae. This condition, illustrated in figure 3, is followed by further wilting of other leaves and buds on the affected branch or shoot. A borer, one-fourth to one-half inch in length, may be found in a small, discolored cavity beneath the black frass. As a result of further excavation by these larvae, normal terminal bud growth is prevented, blooms are small and ill-shaped, and various parts of the plant become broken.

Parts of the branches or stalks break off where the borer cuts a small hole from the inside, pushing out particles of sawdustlike material, as illustrated in figure 3, which cling to the edge of the opening and drop to parts of the plant below. In cases of severe infestation, progressive wilting and breakage result in collapse of the plant before propagating roots are fully formed.

When either roots or green plants are set out in advance of normal planting time, and show five or six sets of leaves by mid-June, dahlias are sometimes infested by the European corn borer in June. The injuries caused at this time are similar to those described above.

SOURCE OF CORN BORERS IN DAHLIAS

The seasonal history of the European corn borer, previous to and including the appearance of the second generation in dahlias, is illustrated in figure 1. It is important for the dahlia grower to note in this diagram that there are two generations of the European corn borer each year and that the larvae of the first generation usually live in early sweet corn and field corn during June and July. These corn-inhabiting larvae change to moths in July and August, and some of the moths fly into dahlia gardens and deposit egg masses upon the under surfaces of dahlia leaves. Egg laying on dahlias may continue for a period of 4 to 6 weeks during late July, all of August, and early September. These egg masses (see figures 1 and 2) are about one-eighth of an inch across and usually consist of from 10 to 25 flattened, overlapping, whitish, disklike eggs. The eggs hatch within a week and the young caterpillars disperse over the dahlia plant.

HOW CORN BORERS GET INTO DAHLIA PLANTS

When one of these tiny caterpillars (less than 1/16 inch in length) crawls into a space between closely appressed foliage at leaf and flower buds, or into an axial shoot between a branch and the stalk, it begins to feed upon the soft tissues of the unexposed parts. Sheltered in these spaces, it continues to excavate, driving deeper into the bud or into the pith of the branch or stalk until eventually it occupies a tunnel large enough to accommodate a full-fed larva that is about 1 inch in length. The type of injury caused by the corn borer in dahlias is determined by the kind of bud in which the young larva becomes established. Establishment of young larvae in terminal and lateral buds, as described above, results later in destruction of foliage and flower buds and in breakage of branches and the stalk.

CONTROL OF THE CORN BORER WITH INSECTICIDES

Several facts of importance in control measures should be noted in connection with the manner in which the corn borer infests dahlias: (1) Entrance is made at points of new growth by very small, newly hatched larvae. (2) This initial infestation usually takes place during late July or in August (depending upon latitude and season). (3) Conspicuous damage, such as breakage in branches, does not occur until the caterpillar has reached a large size and is inside the plant. (4) Unless dahlias are carefully examined for signs of infestation or injury, such as egg masses or wilted leaves, black frass, or castings, and stunted flower buds, the infestation may not be discovered until it is too late to protect the plants from further damage.

Dahlias can be protected from serious corn borer injury if certain insecticidal sprays or dusts are applied with suitable equipment at the right time. This method is effective when the spray or dust is directed at terminal and lateral shoots while the young larvae are feeding upon accessible surfaces in the buds of these shoots.

Insecticidal Materials

The most satisfactory insecticides for use against the European corn borer are made with derris, cube (pronounced koobay), or nicotine. Owing to shortage of derris and cube resulting from war conditions, the use of these insecticides is temporarily restricted by law to certain food crops vital to the war program. Restrictions of use have not been applied to nicotine insecticides. Nicotine, when combined with chemical materials which prevent its loss by evaporation, is a very useful corn borer insecticide. One of these mixtures, nicotine bentonite, can be readily prepared by the dahlia grower who prefers to purchase the separate ingredients for mixing a spray. Required are (1) a container of spray water in which are mixed (2) a spreading or wetting agent, (3) nicotine sulphate (containing 40 percent of nicotine), which is stirred into the spray solution, and (4) dry Wyoming bentonite clay, which should be slowly poured into the spray mixture while it is being vigorously stirred. Chemical compounds called spreading agents are useful in corn borer sprays because they promote penetration of the insecticide into spaces inhabited by young larvae. Ordinary soaps are not suitable for this purpose. The most effective spreading agents for use in corn borer sprays are highly complex chemical products which are sold under various commercial names, as Areskap, In-181, In-438, Santomerse D, and Ultrawet.

Proportions of the materials used in home preparation of nicotine bentonite spray are given in the following formulas:

1. For 50 gallons of spray—

Water	50 gallons
Spreading agent	3 ounces (dry weight) 1/
Nicotine sulphate (40 percent nicotine)	8 ounces (fluid)
Wyoming bentonite clay	2 pounds (dry weight)

2. For 6 1/4 gallons of spray—

Water	6 1/4 gallons
Spreading agent	1/3 ounce (dry weight) 1/
Nicotine sulphate (40 percent nicotine)	1 ounce (fluid)
Wyoming bentonite clay	4 ounces (dry weight)

1/ To facilitate accuracy in measuring small quantities of spreading agent, a stock solution may be prepared by dissolving 3 ounces of spreading agent powder in 1 pint (16 oz.) of water. For example, 8 fluid ounces of this solution will then contain the correct amount of spreader for 25 gallons of spray, and 2 fluid ounces will be enough for 6 1/4 gallons of spray.

The amount of protection obtained from the application of insecticidal spray is also dependent upon the precision with which it is directed at the dahlia plants. Axial and terminal bud growth should be wet thoroughly without washing away residues already deposited in them. These residues are caused by the use of the bentonite clay. Best results are obtained when sufficient pressure is used to force the insecticide deeply into bud growth. It is essential to stir the spray thoroughly when it is mixed and to agitate it frequently during application. Choice blooms intended for exhibition should not be wet by the spray after petals show color in the flower buds. The use of overhead irrigation after sprays or dusts have been applied reduces the effectiveness of insecticidal residues because they are readily diluted and washed from the plants.

For growers who prefer to apply insecticides in dry powder or dust form, several preparations containing nicotine bentonite are available in packages. These are sold under various commercial names and are mixed and ready for use as purchased. To be effective, they should contain not less than 4 percent of nicotine.

Equipment for Applying Insecticides

Standard sprayers having capacities of from 2½ to 30 gallons have been found satisfactory for use in dahlia gardens. Excellent results may be obtained with 2½- or 3-gallon, hand-operated, portable sprayers, as illustrated in figure 4, if the pressure is maintained by frequent pumping. The small quart-size atomizers operated by a plunger of the bicycle-pump type are not always dependable for obtaining satisfactory control. In gardens of 500 or more plants greater convenience is afforded by a wheelbarrow type of sprayer equipped with a 12- to 20-gallon supply tank and 15 feet of hose. The working radius of a wheelbarrow sprayer is increased when the first few feet of hoseline have been elevated sufficiently to permit extension of the hose in any direction. This can be accomplished readily by attaching to the wheelbarrow frame a 3- or 4-foot length of iron rod or strap which has been bent into a loop at its top for holding the hose above the sprayer.

To facilitate direction of the spray to various plant parts, the sprayer hose should be fitted with a lever-operated valve for controlling the spray discharge, and an 18- to 24-inch brass extension pipe, as shown in figure 4. The outer end of the extension pipe should be equipped with a suitable nozzle for breaking the stream of insecticide into a fine misty spray.

Any of the various types of hand-operated dusters is capable of depositing a sufficient quantity of insecticide on the dahlia plant. The hand-operated knapsack type of duster is most suitable for use in both small and large plantings of dahlias. The round terminal opening on the 18- to 24-inch extension tube of most dusters provides a satisfactory discharge of dust; no special nozzle is necessary.

When to Apply Insecticides

Dahlias require insecticidal protection from the European corn borer during a period of 30 days or more, beginning late in July or early in August. A spray or a dust treatment should be applied immediately when signs of infestation have been found, such as hatching of corn borer egg masses or injuries in terminal buds as described on pages 2 and 3. Applications must be repeated thereafter at 5-day intervals, owing to the constant production of new and unprotected bud growth, the continuous hatching of corn borer eggs, and the dilution of insecticidal residues caused by rainfall. For example, if hatching or infestation was first observed and an insecticide applied on July 25, the succeeding applications would be scheduled for July 30, and August 4, 9, and 14, and continued into the first week of September according to the occurrence of corn borer hatching. Somewhat less satisfactory control may be expected when treatments are applied at weekly intervals. If insecticide applications are delayed until a week or two after initial infestation, these treatments should provide protection for the late blooms, but earlier infestation of stalks and branches is likely to cause breakage. On the other hand, blooms become infested when insecticide applications are discontinued too soon.

SUPPLEMENTARY CONTROL MEASURES

Disbudding and Disbranching

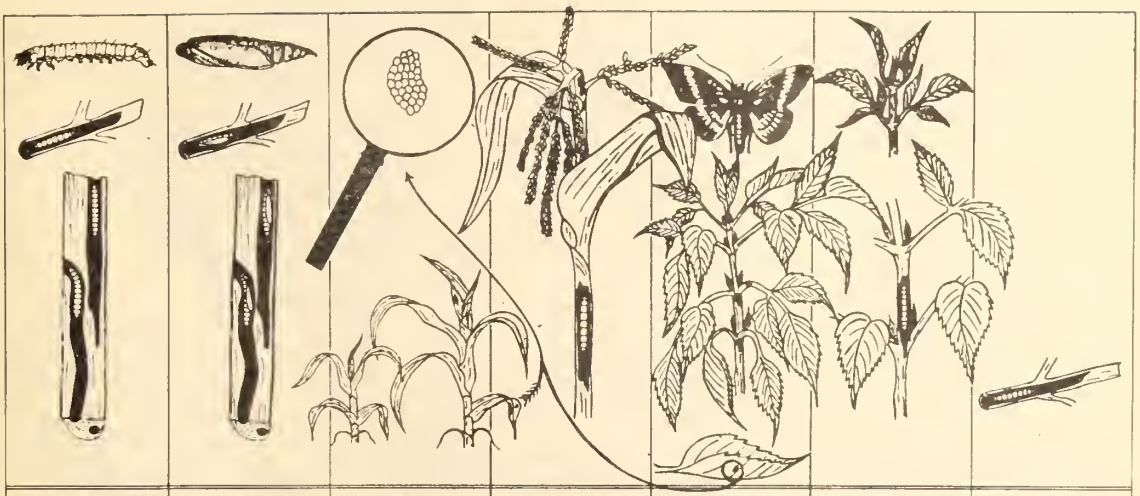
An understanding of how borers get into dahlias suggests several methods that may be adopted for keeping them out. Signs of infestation in shoots and buds, for example, indicate where pruning will prevent further trouble, and removal of infested shoots and buds is sometimes sufficient in gardens that are very lightly infested. However, the corn borer does not always enter those lateral shoots and flower buds that would normally be removed by good pruning practice. Where heavier infestation prevails, disbudding and disbranching cannot be depended upon to protect the plants from serious injuries or the loss of quality blooms.

Use of a Tent

Choice varieties are sometimes grown under complete tents constructed of tobacco shade-cloth, and this practice has been found to reduce infestation greatly. Occasional injury is caused by larvae hatching on nearby plants and gaining access to those grown under the tent, or by larvae hatching from egg masses laid upon the tent, from which the larvae penetrate the screen and drop or crawl to plants within the enclosure. In localities where moisture held inside such a tent does not promote tenderness in the blooms or fungous disease in the plants, this has been found to be a very satisfactory method of keeping borers out of dahlias.

Trimming Root Clumps

Properly trimmed root clumps are not infested. After root clumps have been harvested, the practice of burning dead stalks and other infested debris remaining in the garden will reduce the number of borers that otherwise would become egg-laying moths during the following spring. In preparing root clumps for winter storage, it is considered good practice to remove the stalk near the crown of the plant and below the pith cavity of the stem. This leaves the roots free of borers, as larvae of the European corn borer have not been found to excavate below the crown. Since it is also standard practice among commercial growers to cut off dahlia stalks at the crown, there is no reason to assume that borers will be present in newly purchased root clumps.



OCTOBER TO APRIL	MAY	JUNE	JULY	AUGUST AND SEPTEMBER	SEPTEMBER AND OCTOBER	OCTOBER TO APRIL
OVERWINTERS IN CORN AND DAHLIA STEMS	PUPATION	MOTH FLIGHT: EGGS LAID ON CORN	1ST. GENERATION INFESTS CORN	MOTH FLIGHT: EGGS LAID ON CORN AND DAHLIAS	2ND. GENERATION INFESTS CORN AND DAHLIAS	OVERWINTERS IN DAHLIA AND CORN STALKS

Figure 1.—Seasonal history and developmental stages of the European corn borer in early corn and in dahlias where two generations occur each year.

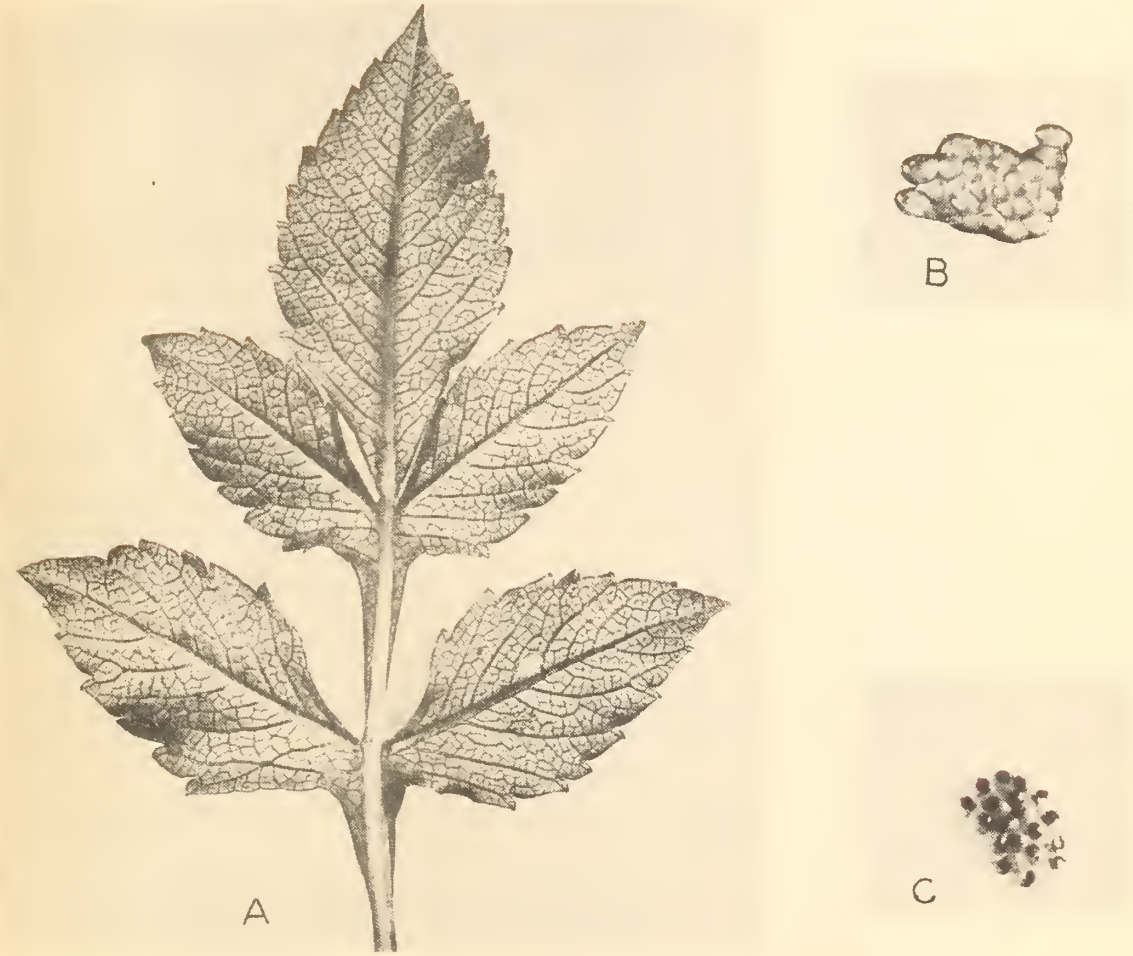


Figure 2.— A, Egg masses of the European corn borer deposited on the under side of fully formed leaves. The egg mass on the leaflet at right is 1 to 4 days old, and the eggs on the terminal leaflet are about to hatch after 5 to 7 days of incubation. B, Egg mass 1 to 4 days old (5 times natural size). C, Eggs 5 to 7 days old, with black heads of embryo larvae showing through eggshells (5 times natural size).

Figure 3.—An advanced stage in the infestation of terminal sections of a branch, resulting in stunting, stem weakness, granular frass, and wilted leaves.

Figure 4.—Spraying dahlias with a small portable sprayer fitted with an extension pipe for directing the spray.